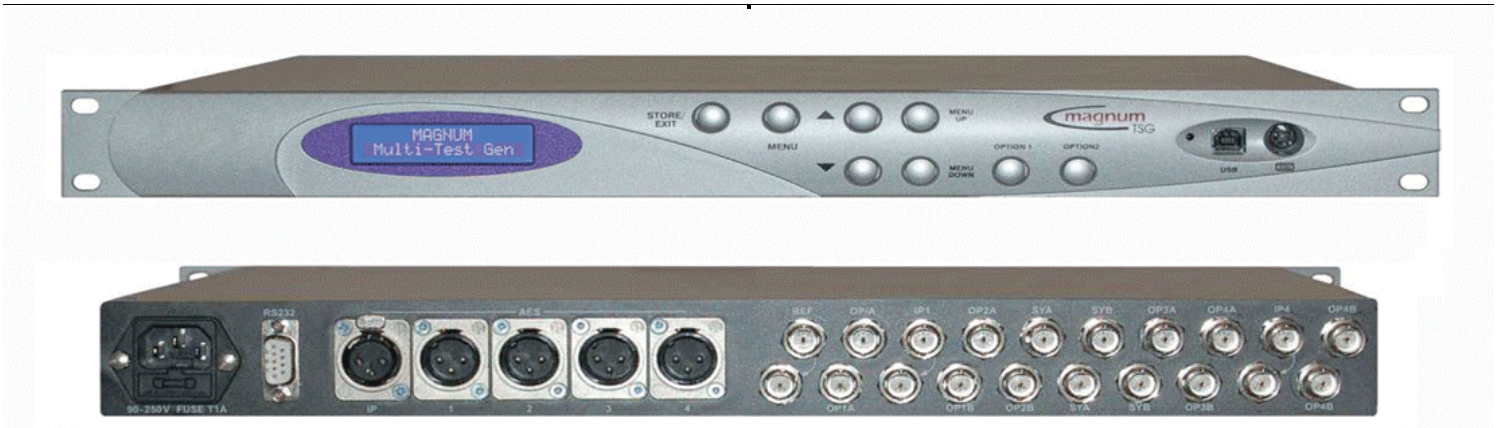

MAGNUM FACILITIES TSG

User Manual

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Overview:
The Magnum Facilities TPG is a multiple output, multiple standard SDI test pattern generator, with additional outputs of analogue syncs and AES audio. In total there are 8 HD/SD SDI output streams, 2 pairs of analogue sync outputs, 4 AES outputs, one analogue reference input, and 2 digital reference inputs.

Clocking and Locking:
The most important limitation is that only one HD frequency clock can be used at one time. This is selected by the user, but this means that it is not possible to have, say, both 1080i 50 and 1080i 59.94 signals available at the same time. However, within this limitation, any combination of standards is available. There is, however, a SD clock (27MHz) running all the time, so 625/50 and 525/59.94 are available simultaneously. The HD clock (74.25MHz or 74.175MHz), the SD clock (27MHz) and the audio clock (12.288MHz) are all locked to one another. The unit will lock off either a SD or HD analogue reference. It is better to lock off a SD source, as this means that either of the HD frequencies can be selected - the unit will not lock if, say, the HD analogue reference is 1080i 59.94, and the HD clock is set to 74.25MHz.

The analogue input not only provides the frequency locking, but also provides frame locking as well. The two SDI digital inputs provide only frame reference. There are limitations here as well, due to the usage of serializers and deserializers within the Xilinx chip. If output 1 is set to SD (525 or 625), then digital reference A must also be a SD signal - whilst if output 1 is set to HD, then digital reference A must be a HD signal (of the same frequency as output 1). The same applies to output 4 and digital reference B, which are similarly linked. However, it is possible to have, say, a 720p/24 signal as the reference input, whilst outputting a 1080i/50 signal.

Standards:
Always available:
525/50 SD and 525/59.94 SD

With HD clock set to 74.25MHz:
1080i60, 1080i50, 1080sf24 (equivalent to 1080i/48)
1080p30, 1080p25, 1080p24
720p60, 720p50, 720p30, 720p25, 720p24

With HD clock set to 74.175MHz:
1080i59.94, 1080sf23.98 (equivalent to 1080i47.95)
1080p29.97, 1080p23.98
720p59.94, 720p29.97, 720p23.98

Connections:
Ref (loop thru BNC's) - Analogue reference input - 525 or 625 preferred
OP1A (2 BNC's) and OP1B - Outputs from Pattern generator 1 - either 2 independent 4:2:2 streams, or one dual link (A & B)
IP1 (input and active loop thru) - SDI reference stream input - must be linked in clock frequency to OP1
OP2A and OP2B - Outputs from Pattern Generator 2 - either 2 independent 4:2:2 streams, or one dual link (A & B)
Syncs A - HD tri-level sync output (standard selectable)
Syncs B - SD syncs (with or without burst, standard selectable)
OP3A and OP3B - Outputs from Pattern generator 3 - either 2 independent 4:2:2 streams, or one dual link (A & B)
OP4A and OP4B (2 BNC's) - Outputs from Pattern Generator 4- either 2 independent 4:2:2 streams, or one dual link (A & B)
AES 1-4 Outputs - 4 independent but co-timed AES streams
AES Input

Control:
There are 8 buttons and a LCD display for selecting the function of the Magnum.
Store/Exit Button - Stores the changed selections, and exits to Default Message
Menu - Selects menu for Pattern Generator parameters, also acts as ESC to go up one menu level
Up and Down - selection of parameter change, and entry in to a lower level menu
Menu Up and Menu Down - selection of Menu
Option 1 - Selects Standards and sync outputs menus
Option 2 - Selects Audio and Miscellaneous features

Parameters:

Parameter changes act immediately. When changing patterns, for instance, pressing the Up key will change from 100% bars, to 100% bars with red, to 75% bars, to 75% bars with red, to Black etc. The maximum time to redraw any pattern is around 100mS, and further button pushes are not accepted until the action has been completed. Audio frequency and level changes will result in instantaneous changes of the output, without clicks. However, once you have altered a parameter, there is not way to revert to the previous value, as the only way out is via the Store/Exit button, which saves the changes.

Notes on Patterns:

The bars are band limited.
Luminance Multi-burst goes to 6MHz for SD, 30MHz for HD
PLUGE has bars of -2%, +2%, +4% on the left hand side - bars of 98% and 102% in the white, and the grey is 20%
Shallow ramp is both luminance and chrominance, the U component decreasing, and the Y & V components increasing - approximately 10% across picture width.
Luminance Ramp is from Black to white.
Chrominance Ramp has flat luminance, and full level ramping chrominance components, the U decreasing from left to right, the V increasing from left to right. This pattern gives illegal RGB values if transcoded!
Grid always gives a 16:9 aspect ratio - meaning that when displayed on SD in 4:3, the boxes are narrow. There is a single horizontal line on one field, and two horizontal lines on the other field - thus field reversal, or field replication can be ascertained

Option 1

Standard:

Available standards can be selected

Locking:

The sources available to lock to are:
Analogue Ref
Digital Reference A (linked to output 1)
Pattern Gen #1
Pattern Gen #2
Pattern Gen #3
Pattern Gen #4
Free (no reference).
Illegal selections are locked out (i.e. locking Gen#1 to Gen#2, and Gen#2 to Gen#1 is not allowed).
Illegal cross locking (i.e. trying to lock a 25 fps output to a 30 fps source will result in the generator dropping into free mode).
Cross locking a 50fps signal (i.e. 720p/50) to a 25fps signal (i.e. 1080i/50) is allowed, but the reverse is not true.

H & F positions:

Changes the horizontal and vertical offset compared to the reference source. This works at present, but the offset values shown should not be taken as being a true indication of the relative positions of the generator and the reference. Further software revisions will cure this.

HD Frequency:

To change the HD frequency, a series of button pushes must be done - this is in order to make it difficult to change inadvertently!. When entering the HD Frequency menu, the frequency will be shown. The change frequency, push Menu Up, push Up, push Option2, push Option 1 - pressing any other key than the correct one will drop you back to the start.

Centre Frequency:

If the Magnum is not being referenced to an analogue source, it can free run, and Centre Frequency can be altered to get the reference 27MHz oscillator close to absolute. If wishing to use this feature, it is suggested that you allow the unit to temperature stabilise, and then compare the SD analogue sync output to, say, an off air source or a known SPG. Setting the value to around 28 will give a centre frequency correct to around 5ppm under all circumstances - which is close enough for any receiving device to lock to.

Option 2:

There are 12 independent tone generators, each of which may be set to any frequency between 20Hz and 22000Hz, and with any level between 0dB and -60dB in 1dB steps. One of these tone generators is assigned to lip sync. Audio silence is also available. Note that the granularity of the frequency settings is around 0.3Hz, so what is shown as 1000Hz, could be anything between 999.7Hz and 1000.3Hz. Similarly, there is granularity of the dB steps in level - ones above 20dB should be accurate to 0.05dB, but the close you get to -60dB, the more error there will be, though never more than 0.25dB. Each tone generator has outputs that are continuous and interrupted (250mS in every 3 seconds), so there are in fact 24 total audio sources. Each of the audio channels (8 AES channels, and 16 channels for each of the 4 Pattern generators) may be selected from any of the 24 sources independently.

MAGNUM OPERATION

The start screen will show the message "Shootview Magnum Facilities", and this will appear either after power up, or after the *Store/Exit* button has been pressed. From this screen, the available options are Menu, Opt1, Opt2.

Menu Button:

Pressing the Menu button allows selection of alteration of parameters of one of the 4 pattern generators. Press the *Menu Up* or *Menu Down* buttons to select one of the 4 pattern generators, and then press *Up* or *Down* to enter the Pattern Menu.

Pattern A:

Selects the pattern on output A. The following patterns are available:

] 100% bars
] 100% bars + red
] 75% bars
] 75% bars + red
] Black
| Luminance Multiburst
] PLUGE
] Shallow Ramp
| Luma Ramp
| Chroma Ramp
] 16:9 grid.
| Pathological Test
n] 100% Green
] 100% Red
] 100% Blue
] 100% White
] 100% Green Ramp
] 100% Red Ramp
] 100% Blue Ramp

Note:

All signals are legal, except the Pluge, Shallow Ramp and Chroma Ramp.
The shallow ramp and chroma ramp may form illegal RGB signals.
The Pluge signal has bars of -2%, +2% and +4% on the left hand side, and within the white area there are bars of 98% and 102%.

Press *Menu Up* to go to -

Lines A
Selects overlay lines. The following options are available
a] None
b] Outer + Safe Title + Safe Action
c] Safe Title + Safe Action
d] Safe Action
e] Safe Title
The "Outer" is a two pixel and two line box showing the extreme limits of the active picture.
Safe Title is 90% of picture width and height - and is solid
Safe Action is 80% of picture width and height - and is dashed
These lines are not band limited.

Press *Menu Up* to go to -

Movement A
Switching on movement shows a moving luminance ramp is the bottom portion of the screen. This is meant as a test to show frozen pictures.

Press *Menu Up* to go to -

dent Line A
Switching on Ident Line will give a single line of text on screen - one of 8 messages may be selected, and the horizontal and vertical position may be changed (see later).

Press *Menu Up* to go to -

Lip Sync A
Switching Lip Sync on gives a flash of 1 frame (2 frames in 720p60,720p59,720p50) of white over the selected output pattern. All embedded audio channels are switched to a signal which has a tone "beep" the same length as the flash - the start of the audio beep is lined up (within one half of an audio cycle) with the start of the video frame with the flash.

Press *Menu Up* to go to -

Embedder A
This controls what audio channels are embedded - the options are
a] None (no embedded signal)
b] Group 1 only
c] Group 2 only
d] Group 3 only
e] Group 4 only
f] Groups 1 & 2
g] Groups 3 & 4
The selection of the audio tones to be embedded is done under the Opt2 menu.

Press *Menu Up* to go to -

Embed Tone A
This gives the option of automatically switching the embedded audio group(s) to silence when the pattern is black.

Press *Menu Up* to go to -
The next 7 menus refer to output B - these menus are not visible when 4:4:4 is selected

Press *Menu Up* to go to -

dent Select - (only visible when Ident A or Ident B selected)
This menu selects one of 8 messages to be displayed as an ident. The idents for A & B outputs are the same, as is their positions (though they are individually enabled on A and B outputs). Plugging in a PS2 keyboard on the front of the Magnum will allow the displayed ident to be edited and saved. The editor is simple!.
Esc brings up the cursor at the start of the line (two presses may be required to allow for keyboard synchronisation after power up).
Arrow Right and Arrow Left move the cursor.
Delete and Backspace work in the normal way.
Any key presses that do not cross to an allowed character are ignored.
Return saves the line, and gets rid of the cursor.
The 8 ident messages are global to the whole machine, but their size and position are adjustable per pattern generator.

Press *Menu Up* to go to -

dent Size
Selects the ident size - small, medium or large. This applies to both the A & B outputs. Changing ident size may also change the ident position automatically, so that the ident does not completely fall off the screen. It is best to select ident size before changing the H & V ident positions.

Press *Menu Up* to go to -

dent H Position - (only visible when Ident A or Ident B selected)
Allows the ident to be moved horizontally. Pressing *Up* and *Down* together centres the ident line on the picture. Note that if the output standard of the generator has been changed, then the H position and V position may need to be altered.

Press *Menu Up* to go to -

dent V Position - (only visible when Ident A or Ident B selected)
Allows the ident to be moved vertically. Pressing *Up* and *Down* together aligns the ident towards to bottom of the picture as a good starting point.

Press *Menu Up* to go to -

Format
If 4:2:2 YUV is selected, then two independent patterns, A & B are available, each with their own selection of lines and movement. If 4:4:4 is selected, then only the A selection is available on the menu.

Pressing Store/Exit at any time stores the new settings in non-volatile storage, and returns to the Start Up screen.

OPTION 1

The controls under Option 1 are concerned with output standards and locking.

MPORTANT: If HD frequency has been changed, then the user should reselect the standard on all pattern generators, ogether with the locking source and H and F phases. Otherwise, anomalies can occur, i.e. if changing from 74.25 to 74.175, a source that was previously 1080i/50 will become an illegal source of 1080i/49.96!!
Care must be taken with locking, if it is desired to cross lock sources or generators. Whilst the Magnum can output any standard, and cross lock in any legal way, changing reference sources or generator standards can have consequences that whilst logically foreseeable, may not be realised at the time. USE OPTION 1 WITH CARE.

There are the following top level menus in Option 1:

1] Standard Gen #1
2] Standard Gen #2
3] Standard Gen #3
4] Standard Gen #4
5] HD Analog Sync Gen
6 SD Analog Sync Gen
7] Reference Info
8] HD Frequency
9 Centre Frequency

Use the Menu Up or Menu Down buttons to select the required function. Press Up or Down to Enter the Menu. Pressing Menu at any point takes you back to the top level, and pressing Store/Exit at any point gets back to the Start Up screen.

For the Generator Standards and the Sync Generators, there are similiar sub menus:

Set Standard

Allows whatever standards are applicable to be selected. Press Up or Down to select.

Press *Menu Up* to go to -

Lock

This menu is where the cross locking of the output standard takes place - and can appear a bit daunting to start with!.
The top line of the LCD display indicates the target frame frequency - thus 1080i/50 will show 25 (frames per second), whilst 720p/50 will show 50 (frames per second), 525 will show 29.97 (frames per second).
Pressing Up will cycle through the various possible sources of frame locking, these being
1] Free Running F - no frame locking is even attempted
For the remaining choices, the bottom line of the display has three values:
To the Left, the selected locking source.
In the Middle, the frame rate of the locking source
To the Right, the result of attempted locking.

Pressing Up cycles through the possible locking sources:

2] AnRef - the analog reference signal
3] DRef1 - Digital Reference 1
4] Gen#1 - Generator 1
5] Gen#2 - Generator 2
6 Gen#3 - Generator 3
7] Gen#4 - Generator 4.

Example:

Suppose the analog reference source is 625/50, and the HD frequency has been selected to 74.25MHz, and we wish to make a 1080i/50 source locked to the analog reference.
From the Start Up screen, press Opt1 to get to Standard Gen #1, and the press Up to get to Set Std Gen 1. Use the Up/Down buttons to select 1080i50.
Press Menu Up to get to the Lock menu, which will read
Lock #1 to 25Hz
Free Running F
This means that at present, whilst the 1080i/50 is frequency locked to the 625 analog sync input, the frame is free running.
Press Up, and the screen changes to
Lock #1 to 25Hz
AnRef 25 Lock
The bottom line indicates an analog reference source, that the reference source is 25Hz, and "Lock" indicates that frame locking has occured.
Should the analog reference not be present, the screen will indicate
Lock #1 to 25Hz
AnRef NoRef Free
Indicating no analog reference, and therefore a free running frame.
Should the analog reference be 525, then the screen will indicate
Lock #1 to 25Hz
AnRef 29.97 Free
Showing the analog reference frame rate is 29.97, and therefore there is no frame locking with a 1080i/50 output signal.

Restrictions on the Digital Reference Input

The digital reference input can take a SD-SDI or HD-SDI signal, and generate a frame locking source. However, due to limitations within the processing, the SDI clock frequency of the digital reference must be notionally the same as Pattern Generator 1. If Patt Gen#1 is set to 525 or 625, the digital reference can be a SD-SDI signal. If Patt Gen#1 is set to HD, with a machine wide HD clock of 74.25MHz, then the digital reference must be a 60, 50, 48, 30, 25 or 24 frame rate HD-SDI signal. If Patt Gen#1 is set to HD with a 74.175MHz clock, then the digital reference must be a 59.94, 47.95, 29.97 or 23.98 frame rate HD-SDI signal.

Press *Menu Up* to go to -

H Phase

H phase alters the phase of the output signal with respect to the selected reference signal in pixel increments. The H Phase and F phases are interlinked, so when the H Phase changes form maximum back to zero (using the Up button), the F phase is incremented, and when the H Phase changes from zero to maximum(using the Down button), the F phase decrements.

Press *Menu Up* to go to -

F Phase

Changes the phase of the output signal with respect to the selected reference signal in line increments.

Press *Menu Up* to go return to Set Standard

Press *Menu* to go back to the Option 1 main menus.

HD An Sync Gen

The HD Analog Sync generator can make syncs in any of the allowable standards at the selected HD frequency, and can lock and phase as per the pattern generators.

SD An Sync Gen

The SD Analog Sync generator can make syncs in 525 or 625, with or without burst. Note that if there is no relationship between burst on any incoming analog reference, and the outgoing analog syncs.

After the 4 pattern generator menus, and the HD and SD sync menus, there are the additional menus.

Reference Info:

The sub menus merely show the reference information for each of the two possible reference sources, Analog sync input, and Digital Reference 1.
Analog syncs can be any SD or HD sync source, irrespective of how the Magnum outputs are set.
The input to Digital Reference 1 (if required to be used) MUST be the same frequency as Pattern Gen #1, but not neccessarily the same standard. So, if Pattern Gen #1 is set to SD 625, the incoming signal on Digital Ref 1 could be SD 525 or SD 625 - if a HD source is connected, then Digital Reference 1 will show as not present. If Pattern Gen #1 is set to HD (74.25), with the output as 1125/50i (say), then a 720p/24 HD source may be connected to Digital Reference 1, which will give a possible 24Hz frame reference to other generators within the Magnum.

HD Frequency

This menu changes the HD frequency between 74.25MHz and 74.175MHz. This menu is deliberately obtuse - to stop inadvertent changing of the HD frequency, which will affect the whole Magnum.
Press Up or Down to enter the menu.
The present HD frequency will be shown. Pressing Menu Up or Menu Down will change the item to Change Frequency - and then pressing Up or Down will start the change frequency process. You now have to press Opt2 to confirm the frequency change, and afterwards Opt 1 to reconfirm (these two steps are prompted). To get out of change frequency, press any other button to abort the change sequence. After you have changed frequency, you must go back and reset all the generators that are outputting HD standards - otherwise anomolies can occur.

Centre Frequency

This sets the centre frequency of the master free-running oscillator. If the Magnum is being used without a reference, then the free run frequency may be trimmed with this control. Nominally, the frequency is correct when set to 128 - and pressing both Up and Down button simultaneously sets this number. If you want to trim the frequency to be as close as possible to a reference, do that when the Magnum has reached temperature stability. Trim values at end points (near 1 or 254) will cause the master oscillator to be more than 50ppm out, and this can mean that downstream devices may not be able to lock to the Magnum.

OPTION 2

Option 2 menus are concerned with the audio generators, the audio matrixing, recalling and storing set-ups, and machine information.
The audio generators and matrixing are global to the whole machine.

Press Opt2 to get to:

Set Audio Tones

The audio tones menu allow you to set up the frequency and level of 12 tone generators, plus the tone generator for lip-sync. You can set the frequency to any whole number of Hertz from 20Hz to 22KHz, and the level in -1dB steps from 0dB to -60dB.

Press Up to get to –

Tone Gen #1 Freq
Use the Up and Down buttons to select the desired frequency for Tone Generator 1, hold the buttons to auto increment or decrement.

Press Up to get to -

Tone Gen#1 Lvl

Use the Up and Down buttons to selected the desire output level for Tone Generator 1.

Press Up again, to get to Tone Gen #1 Freq - etc!

All tone generators can be set for desired frequency and level.

Unless it is wanted to embed externally coded Dolby E signals for lip-sync, leave the Lip Sync Early menu set to 0 Frames!!

Press Menu to exit the Set Audio Tones

Press Menu Up to get to -

AES Output Matrix

There are 4 AES outputs, and each left and right channel of each of these outputs may be sourced from any of the tone generators.

Press Up to get to -

AES Op 1 Left

This selects the tone generator feeding AES 1 Left channel. Pressing Up selects the different tone generators. Note the C and on the lower row of the LCD display. When C, the output tone in Continuous, when I, the output tone is interrupted, for 1/4 second every 3 seconds, as per EBU specs to allow left/right distinction.

By pressing Menu Up, each of the 8 AES output channels may be set.

Press Menu to exit the AES Output Matrix

Press Menu Up to get to -

Gen #1 Matrix

The next four main menus control the matrixing for the embedded audio for the four pattern generators, use them in the same way as the AES Output Matrix to select the desired tone outputs. You can also select silence, or the AES input - thus it is possible to embed an external audio signal. Note that when Lip-sync mode is selected, the embedded audio automatically changes to the lip-sync test pulse.

The number following the Grp refers to the embedded group, and follows the selection of which groups are to be embedded from the pattern generator menu. If only one group has been selected to be embedded, then a letter will follow the Grp, indicating that this group selection is not presently active.

Following the selection of the tones to be embedded, you can select whether, when in lip sync mode, the embedded tone is the internal lip sync source, or the AES input (as when using an external Dolby E encoder).

Press Menu to exit the Generator Matrixes

The next menus are just information, keep pressing Menu Up to get to Recall Set Up.

Storing and Recalling Set Ups

There are 8 whole machine set-ups, which are able to be stored and recalled. These are so the Magnum can be quickly changed between functions.
To store a set-up:
From the Start Up screen, press Opt2 and then Menu Down to get to Store Set Up #1. Press Up or Down to enter.
Now, use the Menu Up or Menu Down keys to select one of 8 stores - the star (*) indicates the set-up the machine is presently on. To store, press Up or Down, followed by Opt2 (prompted), followed by Opt1(prompted). To abort the store operation, press any other key.

To recall a machine set-up, from the Start Up screen, press Opt2, followed by Menu Down, followed by Menu Down. Press Up or Down to enter menu, and then select the required recall by using Menu Up or Menu Down. Press Up or Down to recall, followed by the two prompted buttons. As this is a recall, the Magnum now resets itself (as if a power up), with the recalled settings.
The Labels can be edited in Store or Recall, by plugging in a PS2 keyboard, and pressing escape (maybe twice) to get a cursor up at the start of the label line. Use Arrow Right and Arrow left to move the cursor, use Delete and Backspace to edit, and use Return to store the new label.

Early Lip Sync

The ability exists to generate an early lip sync signal, in order that it may be externally coded (typically Dolby E), and then to embed this signal. This feature is available using Patt Gen#1 as the source.
The Early Lip Sync output is only available on AES output 4. On the Audio Tones menu, after tone generator 11, "Tone Early" will set the frequency and level of the tone output in Early Lip Sync mode when Lip Sync A is off. The frequency and level of the Lip Sync tone (when Lip Sync is on), is set in the next tone generator. The following menu item sets the number of frames early for the Early Lip Sync.
On the AES output 4 matrix, there are additional selections for Early Lip sync (the C and I refer to continuous and interrupted when lip sync A not selected).

To use Early Lip Sync with a Dobly E external coder:

1] Connect the input of the Dolby E encoder to AES output 4, and the output of the encoder to AES input.
2] Set Early Lip Sync (Audio Tones menu) to 1 frame.
3] On the Gen#1 Embed menu, set GEN1A GrpW Lips to Source Internal, and GEN1A GrpX Lips to Source AES input.
4] On Pattern Gen #1 menu, set Embedder A to Groups 1 & 2.
5] On Pattern Gen #1 menu, set Lip Sync A to On.

The effect of this will be to embed the normal lip sync tone on Group 1, and the externally coded Dobly E lip sync on Group 2 - but because the delay in Dobly E encoding is one frame, and the lip sync early was set to one frame, the encoded embedded Dobly E on Group 2 now is in time with the video lip sync flash.

Note: when setting parameters, simultaneously pressing arrow up & down will set the default value.